

Monroe Power Plant
Monroe, Michigan
Evaluation of Compliance with the 1-hour NAAQS for SO₂
September 16, 2015

Conducted by:
Steven Klafka, P.E., BCEE
Wingra Engineering, S.C.
Madison, Wisconsin

1. Introduction

Wingra Engineering, S.C. was hired by Sierra Club to conduct an air modeling impact analysis to help the U.S. Environmental Protection Agency (USEPA), state and local air agencies identify facilities that are likely causing exceedances of the 1-hour sulfur dioxide (SO₂) national ambient air quality standard (NAAQS). This document describes the results and procedures for an evaluation conducted for the Monroe Power Plant located in Monroe, Michigan.

To ensure the modeling analysis reflected the cumulative concentration of SO₂ emissions, it included emissions from the following additional sources of SO₂ emissions located within 50 kilometers of the Monroe Power Plant:

- River Rouge Power Plant - River Rouge, Michigan
- Trenton Channel Power Plant - Trenton, Michigan
- City of Wyandotte Municipal Power Plant - Wyandotte, Michigan
- J.R. Whiting Plant - Erie, Michigan
- Bay Shore Plant - Oregon, Ohio
- U.S. Steel Great Lakes Works - Ecorse, Michigan

The dispersion modeling analysis predicted ambient air concentrations for comparison with the 1-hour SO₂ NAAQS. The modeling was performed using the most recent version of AERMOD, AERMET, and AERMINUTE, with data provided to Sierra Club by regulatory air agencies or obtained through other publicly-available sources as documented below. The analysis was conducted in adherence to all available USEPA guidance for evaluating source impacts on attainment of the 1-hour SO₂ NAAQS via aerial dispersion modeling, including the AERMOD Implementation Guide; USEPA's Applicability of Appendix W Modeling Guidance for the 1-hour SO₂ National Ambient Air Quality Standard, August 23, 2010; modeling guidance promulgated by USEPA in Appendix W to 40 CFR Part 51; USEPA's March 2011 Modeling Guidance for SO₂ NAAQS Designations;¹ and, USEPA's December 2013 SO₂ NAAQS Designations Technical Assistance Document.²

It was determined that based on either current allowable emissions or measured actual emissions, the Monroe Power Plant is estimated to create downwind SO₂ concentrations which exceed the 1-hour NAAQS.

¹ http://www.epa.gov/scram001/so2_modeling_guidance.htm

² <http://www.epa.gov/oaqps001/sulfurdioxide/pdfs/SO2ModelingTAD.pdf>

2. Compliance with the 1-hour SO₂ NAAQS

2.1 1-hour SO₂ NAAQS

The 1-hour SO₂ NAAQS takes the form of a three-year average of the 99th percentile of the annual distribution of daily maximum 1-hour concentrations, which cannot exceed 75 parts per billion (ppb).³ Compliance with this standard was verified using USEPA's AERMOD air dispersion model, which produces air concentrations in units of µg/m³. The 1-hour SO₂ NAAQS of 75 ppb equals 196.2 µg/m³, and this is the value used for determining whether modeled impacts exceed the NAAQS.⁴ The 99th percentile of the annual distribution of daily maximum 1-hour concentrations corresponds to the fourth-highest value at each receptor for a given year.

2.2 Modeling Results

Modeling results for Monroe Power Plant, five other power plants, and one industrial facility are summarized in Table 1. Results are provided for the Monroe Power Plant alone, and for all facilities combined. It was determined that based on either current allowable emissions or measured actual emissions, the Monroe Power Plant is estimated to create downwind SO₂ concentrations which exceed the 1-hour NAAQS.

More specifically, the modeling results presented in Table 1, show exceedances of the NAAQS by the plant's allowable and actual emissions. "Allowable" is the peak emission rate from each unit as approved by the current air quality operation permit for the facility. The allowable emission results are for the six power plants and do not include those from the industrial facility, US Steel.

For the six power plants, "actual" are the measured emissions for each hour between January 1, 2012 and December 31, 2014 as taken from USEPA *Air Markets Program Data*.⁵ For US Steel, actual emissions are the annual average of emissions reported for calendar year 2014.

In addition, the emissions from the other six facilities significantly contribute to the ambient SO₂ concentration in the area impacted by Monroe Power Plant.

Air quality impacts in Michigan are based on a background concentration of 2.6 µg/m³. This is the 2011-13 design value for Wayne County, Michigan - the lowest measured background concentration in the state. This is the most recently available design value. See Section 5 for further discussion of

³ USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO₂ National Ambient Air Quality Standard, August 23, 2010.

⁴ The ppb to µg/m³ conversion is found in the source code to AERMOD v. 14134, subroutine Modules. The conversion calculation is $75/0.3823 = 196.2$ µg/m³.

⁵ <http://ampd.epa.gov/ampd/>

the background concentrations used for this analysis.

Table 1 - SO₂ Modeling Results for Monroe Power Plant Modeling Analysis

Emission Rates	Facility	99 th Percentile 1-hour Daily Maximum (µg/m ³)				Complies with NAAQS?
		Impact	Background	Total	NAAQS	
Allowable	Monroe	220.8	2.6	223.4	196.2	No
Actual		281.3	2.6	283.9	196.2	No
Allowable	All Facilities without Whiting	272.3	2.6	274.9	196.2	No
Actual		289.2	2.6	291.8	196.2	No
Allowable	All Facilities	551.6	2.6	554.2	196.2	No
Actual		289.9	2.6	292.5	196.2	No

The emissions used for the modeling analysis are summarized in Table 2.

Based on the modeling results, Table 3 provides the emission reductions from current allowable rates necessary to achieve compliance with the 1-hour NAAQS. This assumes a one-hour averaging period for the emission rate and that the emission rate is binding at all times. However, given the conservative aspects of this modeling protocol, it is extremely likely that this limit is too high to protect the NAAQS. For example, startup or shutdown periods were not evaluated. During these periods, decreased gas velocities and temperatures may lead to greater ambient impacts at ground level. Further, the hypothetical emission limitation in Table 3 would allow Monroe Power Plant to consume the entire NAAQS, leaving little to no room for any other source of SO₂ in the area. No margin of safety has been included in the hypothetical emission limitation.

Predicted exceedances of the 1-hour NAAQS for SO₂ based on allowable emissions extend throughout the region to a maximum distance of 50 kilometers.

Figure 1 shows the extent of NAAQS violations based on allowable emissions from all six power plants.

Figure 2 shows the extent of NAAQS violations based on actual hourly emissions from all facilities.

Table 2 - Modeled SO₂ Emissions ⁶

Stack ID	Unit ID	Allowable Emissions (lbs/hr)	Actual Emissions (lbs/hr)
M01	Unit 1	2,462.6	2012-14 CEM
M02	Unit 2	2,462.6	2012-14 CEM
M03	Unit 3	2,462.6	2012-14 CEM
M04	Unit 4	2,462.6	2012-14 CEM
Monroe	Facility Subtotal	9,850.2	2012-14 CEM
Bay Shore - B01	Unit B006	1,897.6	2012-14 CEM
R02	Unit 2	3,807.6	2012-14 CEM
R03	Unit 3	4,458.9	2012-14 CEM
River Rouge	Facility Subtotal	8,266.5	2012-14 CEM
T01	Unit 16	907.2	2012-14 CEM
	Unit 17	907.2	2012-14 CEM
	Unit 18	907.2	2012-14 CEM
	Unit 19	907.2	2012-14 CEM
	Stack Subtotal	3,628.8	2012-14 CEM
T02	Unit 9	8,984.8	2012-14 CEM
Trenton Channel	Facility Subtotal	12,613.6	2012-14 CEM
W07	Boiler 07	390.0	2012-14 CEM
W08	Boiler 08	183.0	2012-14 CEM
Wyandotte	Facility Subtotal	573.0	2012-14 CEM
J01	Boiler 1	1,900.0	2012-14 CEM
J02	Boiler 2	2,100.0	2012-14 CEM
J03	Boiler 3	2,400.0	2012-14 CEM
JR Whiting	Facility Subtotal	6,400.0	2012-14 CEM
SV0003	Coke Battery	-	18.8
SV0007	Hot Strip Mill	-	195.3
SV0013	A Furnace BFG Flare	-	38.7
SV0017	D Furnace Baghouse	-	14.1
SV0018	D Furnace Stove	-	123.0
SV0025	No. 2-1 Boiler	-	126.6
US Steel	Facility Subtotal		516.5

⁶ Monroe allowable emissions were taken from MDEQ, Renewal Operating Permit MI-ROP-82816-2009a, July 25, 2011. Bay Shore Plant allowable emissions were taken from OEPA, Final Air Pollution Control Title V Permit, P0105130, June 24, 2014. River Rouge allowable emissions were taken from MDEQ, Renewal Operating Permit MI-ROP-B2810-2012, April 1, 2012. Trenton Channel Power Plant allowable emissions were taken from MDEQ, Renewal Operating Permit 199600204, September 22, 2003. Wyandotte Municipal Power Plant allowable emissions were taken from MDEQ, Renewal Operating Permit MI-ROP-B2132-2010, April 15, 2010. J.R. Whiting Plant allowable emissions were taken from MDEQ, Renewal Operating Permit MI-ROP-B2846-2013, July 1, 2013.

Table 3 - Required Emission Reductions from Monroe Power Plant for Compliance with the 1-hour NAAQS for SO₂

Acceptable Impact (NAAQS - Background) 99th Percentile 1-hour Daily Max (µg/m ³)	Required Total Facility Reduction Based on Allowable Emissions (%)	Required Total Facility Emission Rate (lbs/hr)	Required Total Facility 1-hour Average Emission Rate (lbs/mmbtu)
193.6	65%	3,457.2	0.11

2.3 Conservative Modeling Assumptions

A dispersion modeling analysis requires the selection of numerous parameters which affect the predicted concentrations. For the enclosed analysis, several parameters were selected which under-predict facility impacts.

Assumptions used in this modeling analysis which likely under-estimate concentrations include the following:

- Allowable emissions are based on a limitation with an averaging period which is greater than the 1-hour average used for the SO₂ air quality standard. Emissions and impacts during any 1-hour period may be higher than assumed for the modeling analysis.
- No consideration of facility operation at less than 100% load. Stack parameters such as exit flow rate and temperature are typically lower at less than full load, reducing pollutant dispersion and increasing predicted air quality impacts.
- No consideration of building or structure downwash. These downwash effects typically increase predicted concentrations near the facility.
- Except for the five other power plants and the US Steel facility, no consideration of off-site sources. Any other off-site sources of SO₂ will increase the predicted impacts.

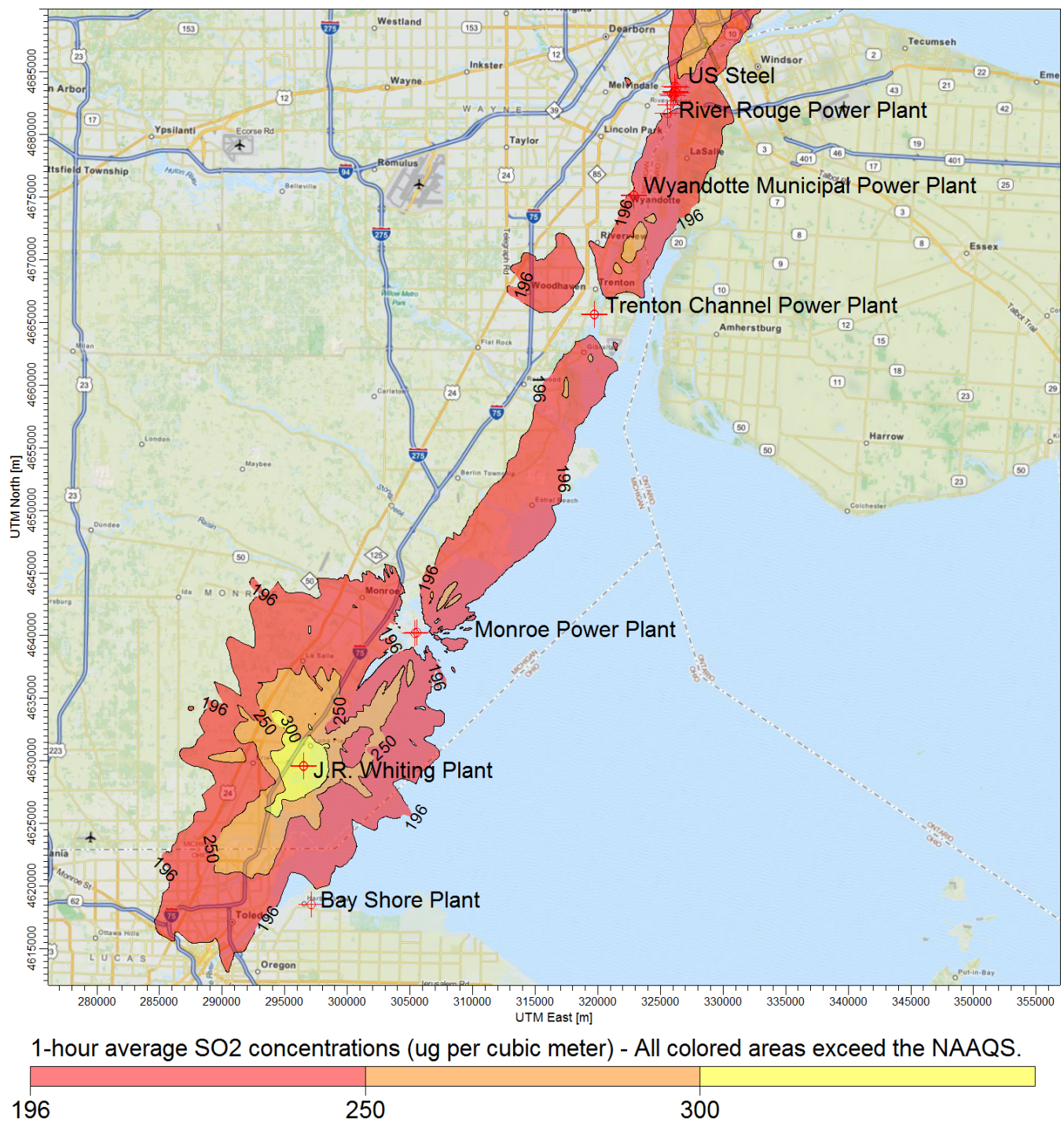


Figure 1 - Regional View of Impacts Based on Allowable Emissions from All Six Power Plants

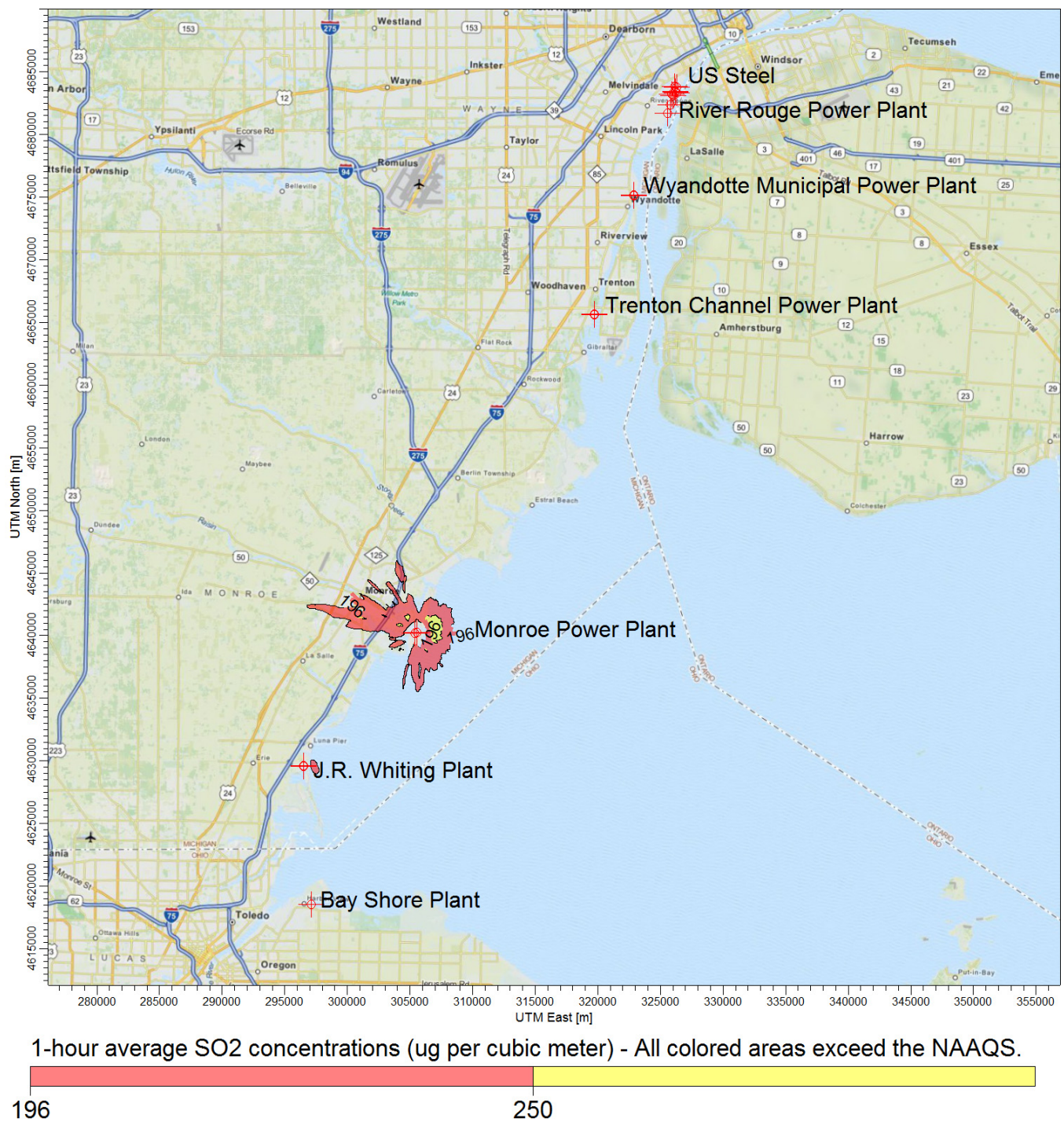


Figure 2 - Regional View of Impacts Based on Actual Emissions from All Facilities

3. Modeling Methodology

3.1 Air Dispersion Model

The modeling analysis used USEPA's AERMOD program, v. 14134. AERMOD, as available from the Support Center for Regulatory Atmospheric Modeling (SCRAM) website, was used in conjunction with a third-party modeling software program, *AERMOD View*, sold by Lakes Environmental Software.

3.2 Control Options

The AERMOD model was run with the following control options:

- 1-hour average air concentrations
- Regulatory defaults
- Flagpole receptors

To reflect a representative inhalation level, a flagpole height of 1.5 meters was used for all modeled receptors. This parameter was added to the receptor file when running AERMAP, as described in Section 4.4.

An evaluation was conducted to determine if the modeled facility was located in a rural or urban setting using USEPA's methodology outlined in Section 7.2.3 of the Guideline on Air Quality Models.⁷ For urban sources, the URBANOPT option is used in conjunction with the urban population from an appropriate nearby city and a default surface roughness of 1.0 meter. Methods described in Section 4.1 were used to determine whether rural or urban dispersion coefficients were appropriate for the modeling analysis.

3.3 Output Options

The AERMOD analysis was based on three years of recent meteorological data. The modeling analyses used one run with three years of sequential meteorological data from 2012-2014. Consistent with USEPA's Modeling Guidance for SO₂ NAAQS Designations, AERMOD provided a table of fourth-high 1-hour SO₂ impacts concentrations consistent with the form of the 1-hour SO₂ NAAQS.⁸

Please refer to Table 1 for the modeling results.

⁷ USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005.

⁸ USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 24-26.

4. Model Inputs

4.1 Geographical Inputs

The “ground floor” of all air dispersion modeling analyses is establishing a coordinate system for identifying the geographical location of emission sources and receptors. These geographical locations are used to determine local characteristics (such as land use and elevation), and also to ascertain source to receptor distances and relationships.

The Universal Transverse Mercator (UTM) NAD83 coordinate system was used for identifying the easting (x) and northing (y) coordinates of the modeled sources and receptors. Stack locations were obtained from facility permits and prior modeling files provided by the state regulatory agency. The stack locations were then verified using aerial photographs.

The facility was evaluated to determine if it should be modeled using the rural or urban dispersion coefficient option in AERMOD. A Geographic Information System (GIS) was used to determine whether rural or urban dispersion coefficients apply to a site. Land use within a three-kilometer radius circle surrounding the facility was considered. USEPA guidance states that urban dispersion coefficients are used if more than 50% of the area within 3 kilometers has urban land uses. Otherwise, rural dispersion coefficients are appropriate.⁹

USEPA’s AERSURFACE v. 13016 was used to develop the meteorological data for the modeling analysis. This model was also used to evaluate surrounding land use within 3 kilometers. Based on the output from the AERSURFACE, approximately 9.9% of surrounding land use around the modeled facility was of urban land use types including Type 21 – Low Intensity Residential, Type 22 – High Intensity Residential and Type 23 – Commercial / Industrial / Transportation.

This is less than the 50% value considered appropriate for the use of urban dispersion coefficients. Based on the AERSURFACE analysis, it was concluded that the rural option would be used for the modeling summarized in this report. Please refer to Section 4.5.3 for a discussion of the AERSURFACE analysis.

⁹ USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005, Section 7.2.3.

4.2 Emission Rates and Source Parameters

The modeling analysis considered SO₂ emissions from Monroe, five other power plants, and one industrial facility. Other off-site sources were not considered. Concentrations were predicted for the scenarios shown in Tables 1 and 2:

- 1) allowable emissions based on the current permit issued by the regulatory agency, and
- 2) for the six power plants actual hourly emissions measured each hour between January 1, 2012 and December 31, 2014 as taken from USEPA *Air Markets Program Data*.¹⁰ For the industrial facility, US Steel, actual emissions are the annual average of emissions reported for calendar year 2014.

Stack parameters and emissions used for the modeling analysis are summarized in Table 4.

The stack parameters and emissions were obtained from regulatory agency documents and databases identified in Section 2.2. The analysis was conducted based on 100% operating load using maximum exhaust flow rates and temperatures. Operation at less than full capacity loads was not considered. This assumption tends to under-predict impacts since stack parameters such as exit flow rate and temperature are typically lower at less than full load, reducing pollutant dispersion and increasing predicted air quality impacts. Stack location, height and diameter were verified using aerial photographs, and flue gas flow rate and temperature were verified using combustion calculations.

¹⁰ <http://ampd.epa.gov/ampd/>

Table 4 – Facility Stack Parameters and Emissions¹¹

Facility	Stack	Description	X Coordinate [m]	Y Coordinate [m]	Base Elevation [m]	Release Height [m]	Exit Temperature [K]	Exit Velocity [m/s]	Inside Diameter [m]	Allowable Emissions [g/s]	Actual Emissions [g/s]
Monroe	M01	Unit 1	305534	4640274	175.71	176.48	325.928	39.624	6.309	310.3	-
	M02	Unit 2	305538	4640278	175.92	176.48	325.928	39.624	6.309	310.3	-
	M03	Unit 3	305379	4640207	177.27	176.48	325.928	39.624	6.309	310.3	-
	M04	Unit 4	305385	4640211	177.25	176.48	325.928	39.624	6.309	310.3	-
Trenton	T01	Units 16 to 19	319707	4665685	177.39	170.38	427.59	42.672	4.42	457.2	-
	T09	Unit 9A	319740	4665610	177.28	171.15	410.93	42.672	4.877	1132	-
River Rouge	R02	Unit 2	325806	4682363	175.03	117.35	420.93	48.768	3.665	479.7	-
	R03	Unit 3	325771	4682374	175.06	129.54	433.15	48.768	3.911	561.8	-
J.R. Whiting	J01	Boiler 1	296512	4629557	176.98	90.53	414.261	16.982	3.231	239.4	-
	J02	Boiler 2	296512	4629576	176.91	90.53	417.039	17.903	3.231	264.6	-
	J03	Boiler 3	296512	4629596	176.92	90.53	426.483	11.665	3.523	302.4	-
Bay Shore	B01	Unit B006	297140	4618518	177.07	91.44	423.706	24.659	3.658	239.1	-
Wyandotte	W07	Unit 7	322901	4675118	175.15	52.73	413.706	8.47	2.794	49.14	-
	W08	Unit 8	322853	4675144	176.51	65.53	435.928	10.71	1.981	23.05	-
US Steel	SV001	Coke Battery	325930.8	4683222	177.32	14.63	294.261	21.105	0.509	-	1.751
	SV003	Hot Strip Mill	326024.8	4683094	177.06	34.75	366.483	10.349	3.048	-	2.369
	SV007	A Furnace	325549.8	4681690	175.29	31.09	477.594	1.617	4.267	-	24.61
	SV0013	D Baghouse	326107.8	4683835	176.6	33.22	544.261	21.184	1.396	-	4.876
	SV0017	D Stove	326179.8	4683430	177.04	20.73	294.261	15.25	3.292	-	1.777
	SV0018	No. 2-1 Boiler	326207.8	4683389	176.96	70.1	560.928	13.531	2.819	-	3.301
	SV0020	No. 1-1 Boiler	326326.8	4683772	176.45	20.73	560.928	17.106	1.676	-	8.53
	SV0025	No. 2-1 Boiler	326278.8	4683326	176.77	26.82	560.928	7.484	2.972	-	15.95

¹¹ Monroe, River Rouge, Trenton Channel, Wyandotte and Whiting stack parameters obtained from USEIA, 2012 Form EIA-860 Data - Schedule 6, Stack & Flue Data, <http://www.eia.gov/electricity/data/eia860/>. Bay Shore stack parameters obtained from OEPA, Facility Profile Report, September 8, 2015. US Steel stack parameters and actual emissions obtained from MDEQ, Michigan Air Emissions Reporting System (MAERS) for 2014.

4.3 Building Dimensions

No building dimensions or prior downwash evaluations were available. Therefore this modeling analysis did not address the effects of downwash and this may under-predict impacts.

4.4 Receptors

For Monroe Power Plant, three receptor grids were employed:

1. A 100-meter Cartesian receptor grid centered on Monroe Power Plant and extending out 5 kilometers.
2. A 500-meter Cartesian receptor grid centered on Monroe Power Plant and extending out 10 kilometers.
3. A 1,000-meter Cartesian receptor grid centered on Monroe Power Plant and extending out 50 kilometers. 50 kilometers is the maximum distance accepted by USEPA for the use of the AERMOD dispersion model.¹²

A flagpole height of 1.5 meters was used for all these receptors.

Elevations from stacks and receptors were obtained from National Elevation Dataset (NED) GeoTiff data. GeoTiff is a binary file that includes data descriptors and geo-referencing information necessary for extracting terrain elevations. These elevations were extracted from 1 arc-second (30 meter) resolution NED files. The USEPA software program AERMAP v. 11103 is used for these tasks.

4.5 Meteorological Data

To improve the accuracy of the modeling analysis, recent meteorological data for the 2012-2014 period were prepared using the USEPA's program AERMET which creates the model-ready surface and profile data files required by AERMOD. Required data inputs to AERMET included surface meteorological measurements, twice-daily soundings of upper air measurements, and the micrometeorological parameters surface roughness, albedo, and Bowen ratio. One-minute ASOS data were available so USEPA methods were used to reduce calm and missing hours.¹³ The USEPA software program AERMINUTE v. 14237 is used for these tasks.

For this modeling project, pre-processed meteorological data were provided by the Michigan Department of Environmental Quality (DEQ).^{14, 15} Data for the 2012 to 2013 period were downloaded from the DEQ

¹² USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, Section A.1.(1), November 9, 2005.

¹³ USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, p. 19.

¹⁴ Michigan Department of Environmental Quality, Map of Available Meteorological Stations, http://www.michigan.gov/documents/deq/deq-aqd-mm-met_support_256121_7.pdf

web site and data for the 2014 period were provided directly by DEQ. The agency prepared its meteorological data using the procedures described in this report.

This section discusses how the meteorological data was prepared for use in the 1-hour SO₂ NAAQS modeling analyses. The USEPA software program AERMET v. 14134 is used for these tasks.

4.5.1 Surface Meteorology

Surface meteorology was obtained for Custer Airport located near the Monroe Power Plant. Integrated Surface Hourly (ISH) data for the 2012-2014 period were obtained from the National Climatic Data Center (NCDC). The ISH surface data was processed through AERMET Stage 1, which performs data extraction and quality control checks.

4.5.2 Upper Air Data

Upper-air data are collected by a “weather balloon” that is released twice per day at selected locations. As the balloon is released, it rises through the atmosphere, and radios the data back to the surface. The measuring and transmitting device is known as either a radiosonde, or rawindsonde. Data collected and radioed back include: air pressure, height, temperature, dew point, wind speed, and wind direction. The upper air data were processed through AERMET Stage 1, which performs data extraction and quality control checks.

For Monroe Power Plant, the concurrent 2012-2014 upper air data from twice-daily radiosonde measurements obtained at the most representative location were used. This location was the White Lake, Michigan measurement station. These data are in Forecast Systems Laboratory (FSL) format and were downloaded in ASCII text format from NOAA’s FSL website.¹⁶ All reporting levels were downloaded and processed with AERMET.

4.5.3 AERSURFACE

AERSURFACE is a program that extracts surface roughness, albedo, and daytime Bowen ratio for an area surrounding a given location. AERSURFACE uses land use and land cover (LULC) data in the U.S. Geological Survey’s 1992 National Land Cover Dataset to extract the necessary micrometeorological data. LULC data was used for processing meteorological data sets used as input to AERMOD.

AERSURFACE v. 13016 was used to develop surface roughness, albedo, and daytime Bowen ratio values in a region surrounding the meteorological data collection site. AERSURFACE was used to

¹⁵ Email from J. Haywood – MDEQ to S. Klafka – Wingra Engineering, S.C., Request for AERMOD Modeling Meteorology for Michigan Power Plants, May 18, 2015.

¹⁶ Available at: <http://esrl.noaa.gov/raobs/>

develop surface roughness in a one kilometer radius surrounding the data collection site. Bowen ratio and albedo was developed for a 10 kilometer by 10 kilometer area centered on the meteorological data collection site.

4.5.4 Data Review

Missing meteorological data were not filled as the data file met USEPA's 90% data completeness requirement.¹⁷ The AERMOD output file shows there were 2.1% missing data.

To confirm the representativeness of the airport meteorological data, the surface characteristics of the airport data collection site and the modeled source location were compared. Since the Custer Airport is located close to Monroe Power Plant, this meteorological data set was considered appropriate for this modeling analysis.¹⁸ This weather station provided high quality surface measurements for the most recent 3-year time, and had similar land use, surface characteristics, terrain features and climate. Finally, DEQ provided pre-processed meteorological data for this project and had concluded that the weather stations were representative of the project location.

5. Background SO₂ Concentrations

Background concentrations were determined consistent with USEPA's Modeling Guidance for SO₂ NAAQS Designations.^{19, 20} To preserve the form of the 1-hour SO₂ standard, based on the 99th percentile of the annual distribution of daily maximum 1-hour concentrations averaged across the number of years modeled, the background fourth-highest daily maximum 1-hour SO₂ concentration was added to the modeled fourth-highest daily maximum 1-hour SO₂ concentration.²¹ Background concentrations were based on the 2011-13 design value measured by the ambient monitors located in Michigan.²²

6. Reporting

All files from the programs used for this modeling analysis are available to regulatory agencies. These include analyses prepared with AERSURFACE, AERMET, AERMAP, and AERMOD.

¹⁷ USEPA, Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-05, February 2000, Section 5.3.2, pp. 5-4 to 5-5.

¹⁸ USEPA, AERMOD Implementation Guide, March 19, 2009, pp. 3-4.

¹⁹ USEPA, Area Designations for the 2010 Revised Primary Sulfur Dioxide National Ambient Air Quality Standards, Attachment 3, March 24, 2011, pp. 20-23.

²⁰ USEPA, SO₂ NAAQS Designations Modeling Technical Assistance Document, Dec. 2013, section 8.1, pp 27-28.

²¹ USEPA, Applicability of Appendix W Modeling Guidance for the 1-hour SO₂ National Ambient Air Quality Standard, August 23, 2010, p. 3.

²² <http://www.epa.gov/airtrends/values.html>